



RUTGERS EDUCATION AND EMPLOYMENT RESEARCH CENTER

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**FIRST IN THE WORLD –  
AMP-UP, UNION COUNTY COLLEGE:**

**Final Evaluation Report**

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## INTRODUCTION

For students in community colleges, coursework in developmental (also called remedial) math can present a significant hurdle impacting both persistence and degree completion (Complete College America, 2012). These negative impacts of developmental math placement are disproportionately experienced by poor students and students color, exacerbating performance gaps (Attewell, Lavin, Domina, & Levey, 2006). Thus, remedial policies that were designed to increase college success have had the opposite effect. Most researchers and policymakers agree that some mathematics coursework may be necessary in college, but not all students need the same mathematics preparation for their careers. More broadly, mathematics sequences proceeding through algebra with the presumed goal of calculus—the pathway emphasized in K–12 and postsecondary education—seem at odds with workers' reported mathematics use at work (Douglas & Attewell, 2017). Even researchers within the mathematics discipline recognize that college algebra often marks the end of formal mathematics study for students rather than serves as a prerequisite for further study (Gordon, 2008; National Research Council, 2013).

Recognizing the practical implications of long sequences of developmental courses students often fail to complete, policymakers across the country have started modifying developmental coursework requirements (Bailey, et al., 2016). Corequisite remediation has emerged as a promising approach to reducing attrition rates related to developmental placement. Corequisite remediation allows students who would have been required to take noncredit developmental courses to proceed directly to credit-bearing college-level work. After the state passed its AB 705 Law, California's Community College system eliminated its developmental pathways and began offering credit-bearing courses to all students (Xia, 2017; Zinshteyn, 2019). Colorado has reformed developmental pathways in both English and mathematics, moving toward a corequisite model for the latter (McKay, Michael, & Khudododov, 2016). Some campuses in the City University of New York have experimented with corequisite placement into statistics, showing important evidence of effectiveness (Logue, Watanabe-Rose, & Douglas, 2016; Logue, Douglas, & Watanabe-Rose, 2019).

In 2016, Union County College began an experiment with corequisite developmental mathematics as part of a grant from the U.S. Department of Education's First in the World (FITW) program.<sup>1</sup> In this experiment, students assessed as needing to take developmental mathematics courses would be eligible to receive a waiver from their developmental requirements and instead proceed to college-level mathematics courses. Students selected to receive a waiver would also be required to participate weekly in tutoring services offered by the college. The Education and Employment Research Center at Rutgers University served as the external evaluator for the study. The evaluation focuses on three key outcomes: continuous enrollment, passing college-level mathematics, and degree completion.

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<sup>1</sup> Union County College had conducted a pilot study of the corequisite intervention in the academic year prior the grant.

## METHODS

The evaluation used a randomized controlled trial (RCT) to assess program impacts on student-level outcomes in three domains – progress in college, academic achievement, and degree completion. RCTs are considered the gold standard in assessing the impact of educational interventions. The evaluation was designed to meet What Works Clearinghouse (WWC) group design standards without reservations. Those design standards inform the presentation that follows.

### **Random Assignment and Sample Formation**

First-time students at Union County College assessed as needing developmental coursework in mathematics were eligible to participate in the RCT. Random assignment took place at the Union County College's testing center. Students who placed into college-level math were not informed about the study. Students who placed into developmental math were informed about and invited to take part in the study. Those who agreed to join the study were asked to sign a consent form. Prior to each recruitment period, the evaluation team created a random assignment spreadsheet using a random sequence generator and used this list to fill numbered envelopes.<sup>2</sup> Consenting students were each given one envelope that contained their group assignment. The testing center staff would then record each student's identifying information, envelope number, and group assignment. This procedure allowed the evaluation team to audit the random assignment process.

Students were randomized into Union County College's AMP-UP experiment each semester beginning in Fall 2016 until Spring 2019. The analysis presented here focuses on three-year outcomes for students randomly assigned in Fall 2016 and Fall 2017.

### **Intervention Condition**

Students randomly assigned to the intervention condition were given a pre-signed registration form from their developmental math requirement that allowed them to register in college-level math courses. They were also required to visit at Union County College's Academic Learning Center, a peer tutoring center, during their first math course. There were no specialized college-level-math sections for AMP-UP treatment group students, and math instructors were not told whether there were any AMP-UP students in their class sections. AMP-UP staff reminded students to go for tutoring. Students received weekly email reminders from AMP-UP staff to attend tutoring, prompts if they did not attend, and notes of praise if they did. Students in the intervention group also had access to enhanced content using Cengage MindTap software.

### **Comparison Condition**

Students randomly assigned to the comparison condition were not given a pre-signed registration form and proceeded with their developmental course placement. Students in the

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<sup>2</sup> The random sequence generator is available at <https://www.random.org/sequences/>

comparison group also had access to Union County College’s Academic Learning Center, a resource available to all students, but they received no special reminders or prompts about using this resource from AMP-UP staff. However, if they went to the ALC they received the same emails of praise that the treatment group did. Regardless of group assignment, students were not required to immediately enroll in a math course. In some cases, students were allowed to enroll with their assignment, in later semesters. This was a decision made by college administration.

### **Analytic Strategy and Data Sources**

Given the nature of the RCT, the evaluation uses an Intent-to-Treat design. We compare students as assigned and allow any post-random-assignment behavior to vary naturally. Thus, the RCT compares the treatment group – those who received waivers and were asked to participate in tutoring – with the control group – those who proceeded with the college’s business-as-usual policies.

AMP-UP program staff provided the evaluation team with all of the data needed to conduct this analysis including student data, random assignment status, and student characteristics, along with term and course-unit data for all consenting students.

### **Dependent Variables**

This report focuses on three outcomes across three dimensions of postsecondary student success. Progress in college is operationalized as the number of Fall or Spring terms enrolled during the three-year study period. Academic achievement is operationalized as whether a student ever completed a college-level course in mathematics in the three-year period. Degree completion is operationalized as whether a student completed a degree program in the three-year period.

### **Independent Variables**

The main independent variable here is the binary indicator of whether a student was assigned to the intervention or comparison condition. In addition, we also collect measures of key student traits – gender, race/ethnicity, whether the student received a Pell grant in the random assignment term, and their score on the Accuplacer math exam prior to random assignment. Gender is a binary variable – male or female – and race/ethnicity uses the IPEDS classification. Pell grant status and Accuplacer scores are measures of student socioeconomic status and prior academic achievement, respectively. The What Works Clearinghouse defines SES and prior academic achievement as key measures of baseline equivalence for studies of postsecondary support interventions (What Works Clearinghouse, 2019). As such, they play a particularly important role in the analysis that follows.

## FINDINGS

**Table 1: Descriptive Statistics for the Corequisite AMP-UP Intervention and Business-As-Usual Comparison Groups, Fall 2016 and 2017 cohorts combined.**

	Business-As-Usual Comparison Group (N=834)	Corequisite AMP-UP Intervention Group (N= 844)
<i>Cohort</i>		
Fall 2016	424 (50.8%)	460 (54.5%)
Fall 2017	410 (49.2%)	384 (45.2%)
<i>Age</i>		
Mean (SD)	26.4 (7.8)	26.1 (7.1)
<i>Gender</i>		
Male	385 (46.2%)	421 (49.9%)
Female	448 (53.8%)	423 (50.1%)
<i>Race/Ethnicity</i>		
White	94 (11.3%)	104 (12.3%)
Asian	17 (2.0%)	13 (1.5%)
Black/African American	305 (36.6%)	319 (37.8%)
Hispanic	292 (35.0%)	295 (35.0%)
Other/Multiple Selected	30 (3.6%)	30 (3.6%)
Unknown	96 (11.5%)	83 (9.8%)
<i>Pell in Cohort Year*</i>		
No	521 (62.5%)	478 (56.6%)
Yes	313 (37.5%)	366 (43.4%)
<i>Accuplacer Score</i>		
Mean (SD)	38.6 (13.9)	38.6 (13.8)

\*p<.05

Table 1 presents the characteristics of students randomly assigned to the intervention and comparison groups in Union County College's AMP-UP experiment. The data indicate that the random assignment process produced generally balanced groups. There are no statistically significant differences in the following average group traits: age, gender, race/ethnicity, and academic preparation as indicated by Accuplacer exam scores. The one exception to the observed group balance is financial aid status. A larger proportion of students in the intervention group received Pell grants in the semester in which they entered college. Though this difference is statistically significant, it is still within the WWC boundaries for baseline equivalence.<sup>3</sup> As such, we include both Pell status and Accuplacer in the models estimating treatment effects.

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<sup>3</sup> The threshold for baseline equivalence is mean differences between 0.05 and 0.25 of the pooled standard deviation for each measure (What Works Clearinghouse, 2020).

**Table 2: Three-Year Outcomes for the Corequisite AMP-UP Intervention and Business-As-Usual Comparison Groups, Fall 2016 and 2017 cohorts – Unadjusted Comparisons**

	Business-As-Usual Comparison Group (N=834)	Corequisite AMP-UP Intervention Group (N= 844)
<i>Retention</i>		
Terms Enrolled – Mean (SD)	2.41 (2.08)	2.54 (2.03)
<i>Academic Performance</i>		
Passed Any College-Level Math***	229 (27.5%)	328 (38.9%)
<i>Completion</i>		
Earned a Degree	114 (13.7%)	125 (14.8%)

\*\*\*p<.001

Table 2 presents unadjusted group comparisons of three-year outcomes in three domains: retention, academic performance, and college completion. Students in the intervention group enrolled, on average, in a slightly higher – but not statistically significant – number of terms (2.5) than students in the comparison group (2.4). When we look at academic performance, we see that intervention group students were far more likely to complete a college-level math course (38.9%) than their peers in the comparison group (27.5%). This difference in college math completion is statistically significant. However, we do not observe that this advantage translates into degree completion, as students in the intervention group (14.8%) are only slightly more likely to have completed a degree within three years than students in the comparison group (13.7%) – a difference that lacks statistical significance.

**Table 3: Linear and Logistic Regressions Predicting Three-Year Outcomes**

	Outcome = Terms Enrolled	Outcome = Pass Any College-Level Math <sup>b</sup>	Outcome = Earned a Degree <sup>b</sup>
Corequisite Intervention	0.06	1.68***	1.06
Group Member	(0.09)	(0.18)	(0.15)
Received Pell in Cohort Year	1.37*** (0.10)	2.05*** (0.23)	1.90*** (0.27)
Accuplacer Score	0.02*** (0.003)	1.04*** (0.004)	1.03*** (0.005)

<sup>b</sup>Odds Ratios Reported

\*\*\*p<.001

Table 3 adjusts the comparisons based on students' academic preparation and socioeconomic status as indicated by Accuplacer scores and Pell recipient status, respectively. Adding these covariates does not substantially alter the estimates of the effect of treatment on the outcomes. We note that both the SES and prior academic achievement indicators are significant positive predictors of the three outcomes, which warrants their inclusion in the estimation of treatment effects. In Tables A1 and A2, included as an appendix to this report, we report the results of further examination of these differences using propensity score matching and by using an expanded set of student characteristics. These tests yielded similar results.

## DISCUSSION

Union County College experimented with corequisite developmental math as an alternative to the traditional model of mathematics placement testing and noncredit developmental coursework. In general, this approach involved allowing students assessed as needing developmental math coursework an opportunity to proceed directly to college-level mathematics with additional encouragement to utilize the college's Academic Learning Center for tutoring support. Our formative evaluation showed that Union County College made many changes to its developmental education protocols over the course of the study period, which altered the experimental setting.<sup>4</sup> As such, the results of this summative assessment should be interpreted with caution and in that evolving context.

The RCT was generally successful in producing balanced treatment and comparison groups; while the treatment group had a somewhat greater proportion of Pell grant recipients, this difference is within the WWC boundaries for baseline equivalence. The RCT had no attrition from the outcomes examined here.

The outcomes assessment found that students assigned to the intervention group – those who had the immediate opportunity to proceed to college-level mathematics with support – benefitted primarily from the intervention itself. In other words, intervention group students were substantially more likely to have passed a college-level mathematics course within three years than their counterparts in the comparison group, who would have had to first complete a developmental mathematics sequence prior to enrolling in college-level math. Assignment to the treatment group did not, however, have a measurable impact on either student persistence at the college or on degree completion in the study period. This result remained consistent in the unadjusted comparisons in Table 2 and in the adjusted models in Table 3.

The null findings for retention stand to reason; completing a single course is unlikely to determine a given students' long-term postsecondary outcomes. The null findings with respect to degree completion may relate to factors immanent to and beyond the scope of the experiment.

Union County College's experiment follows a "randomized encouragement design" (RED) (West et al., 2008). In RED studies, participants assigned to the intervention group are provided with the means to take up the intervention and are encouraged to do so, but they are not compelled to comply with their assigned status. In this case, intervention group students were provided a pre-signed registration form that permitted them to enroll directly into college-level math. But neither intervention nor comparison group students were required to enroll in any math course at the time of random assignment. The encouragement was successful, however: At the end of three years, 74 percent of the intervention group had taken at least one math course, while only 65 percent of the comparison group had done so. But insofar as the intervention is only effective when students actually begin taking mathematics, which is a graduation requirement, the evidence generated by this experiment is limited by less-than-full

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<sup>4</sup> We document two such substantial changes below. For additional information from our formative analysis, see Coty, Edwards & McKay (forthcoming).

uptake. In separate analyses (not shown) we estimated complier average causal effects; these did not vary substantially from the findings presented above.

Union County College's AMP-UP intervention existed alongside a rapidly changing developmental placement landscape at the college. In the first two years of the experiment – the cohorts evaluated in this report – developmental placement policies remained constant. Thereafter, there were a number of consequential changes that may have impacted students across cohorts. We briefly discuss two of these changes below.

In Fall 2018, college-level math courses for liberal arts majors were opened to all Union County College students. Developmental math became effectively optional for most non-STEM, non-Health majors. These introductory college-level math courses were also redesigned to accommodate the changes to developmental placement. Any student, including control group students from the first two cohorts, was eligible to enroll in these redesigned courses. Students interested in majors that required college algebra were still subject to developmental placement based on Accuplacer scores.

In Spring 2019, Union County College adopted the redesigned Accuplacer exam for placement decisions. This change most likely only affected new incoming students. In Fall 2019, college algebra was redesigned and became a dev-ed optional course. Similar to the Fall 2018 change, this shift may have affected students in the sample analyzed for this report. We speculate that the changes to Union County College's developmental placement over time led to a convergence between the intervention and comparison conditions, which may explain the null findings for three-year student outcomes.

As a comparison, another random-assignment study of corequisite mathematics, in which these contextual factors did not play a role, found that after three years, students placed in corequisite math earned more total credits and were substantially more likely to complete their degrees (Logue, Watanabe-Rose, & Douglas, 2016; Logue, Douglas, & Watanabe-Rose, 2019).<sup>5</sup> The pace of change to Union County College's developmental placement landscape may have limited the capacity of this evaluation to understand the broader impacts of this particular intervention.

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<sup>5</sup> Those researchers also had access to degree completion data from the National Student Clearinghouse, which provided a more comprehensive estimate of degrees completed by participants.

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## APPENDIX

**Table A1. Odds of Intervention Group Assignment, Logistic Regression**

	WWC Key Variables Only	Expanded Covariate Set
Pell in Cohort Year (ref: No)		
Yes	1.27 (0.13)*	1.30 (0.13)**
Accuplacer Score	1.00 (0.004)	1.00 (0.004)
Age	--	1.00 (0.006)
Gender (ref: Male)		
Female	--	0.84 (0.09)
Race/Ethnicity (ref:White)		
Asian	--	0.62 (0.25)
Black/African American	--	0.90 I0.15)
Hispanic	--	0.86 (0.14)
Other/Multiple Selected	--	0.89 (0.26)
Unknown	--	0.75 (0.26)
N of Cases	1,677	1,675

\*p<.05 \*\*p<.01

**Table A2. Propensity Score Matched Analysis of Student Outcomes**

	Average Treatment Effect
Retention	
Terms Enrolled – Mean (std. error)	0.008 (0.10)
Academic Performance	
Passed any College-Level Math	0.11 (0.02)***
Completion	
Earned a Degree	0.003 (0.02)

\*\*\*p<.01